Collaborative computing

~~Computer-Supported Cooperative Work~~

~~Groupware and Collaborative Interaction~~

Michel Beaudouin-Lafon
Université Paris-Saclay
mbl@lisn.fr

Thanks to Nicolas Roussel, Inria,
Cédric Fleury, ENIB,
Anastasia Bezerianos, U. Paris-Saclay

Humans are social beings ...

Groups structure human activity

Professional life: teams, management chain,

Private life: family, friends, sport teams, choir, etc.

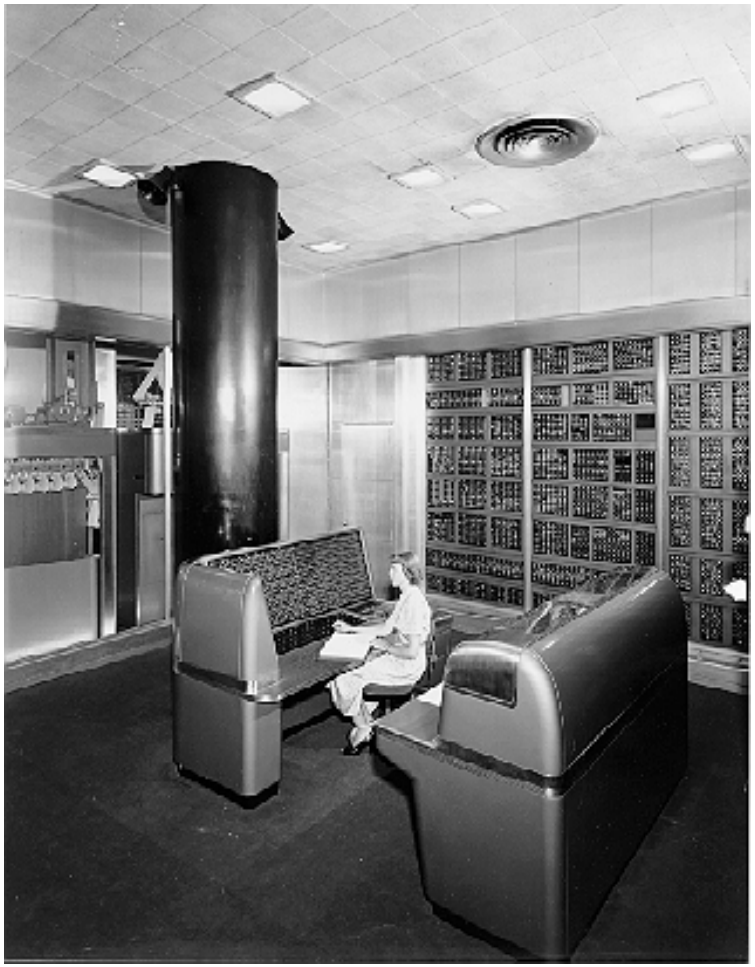
Groups are more than the sum of their parts

- Division of labor
- Take advantage of different expertise
- Transfer of skills: learning

... but computers are (mostly) personal

Time-sharing systems create the illusion that each user has access to all the resources and do not support awareness of what other users are doing.

Example: file system



IBM SSEC, 1948

The PC is … the personal computer

Designed for one user

performing one task

with one computer

We live in a “connected” world

Or do we?

Trapped inside applications

Email:
open and interoperable

Social networks:
closed and proprietary

Disowned of our files

My files:
personal control

The cloud:
sharing means giving away

No control over the means of communication

Telephone:
choice of operator and device

Videoconferencing: everybody
must use the same service

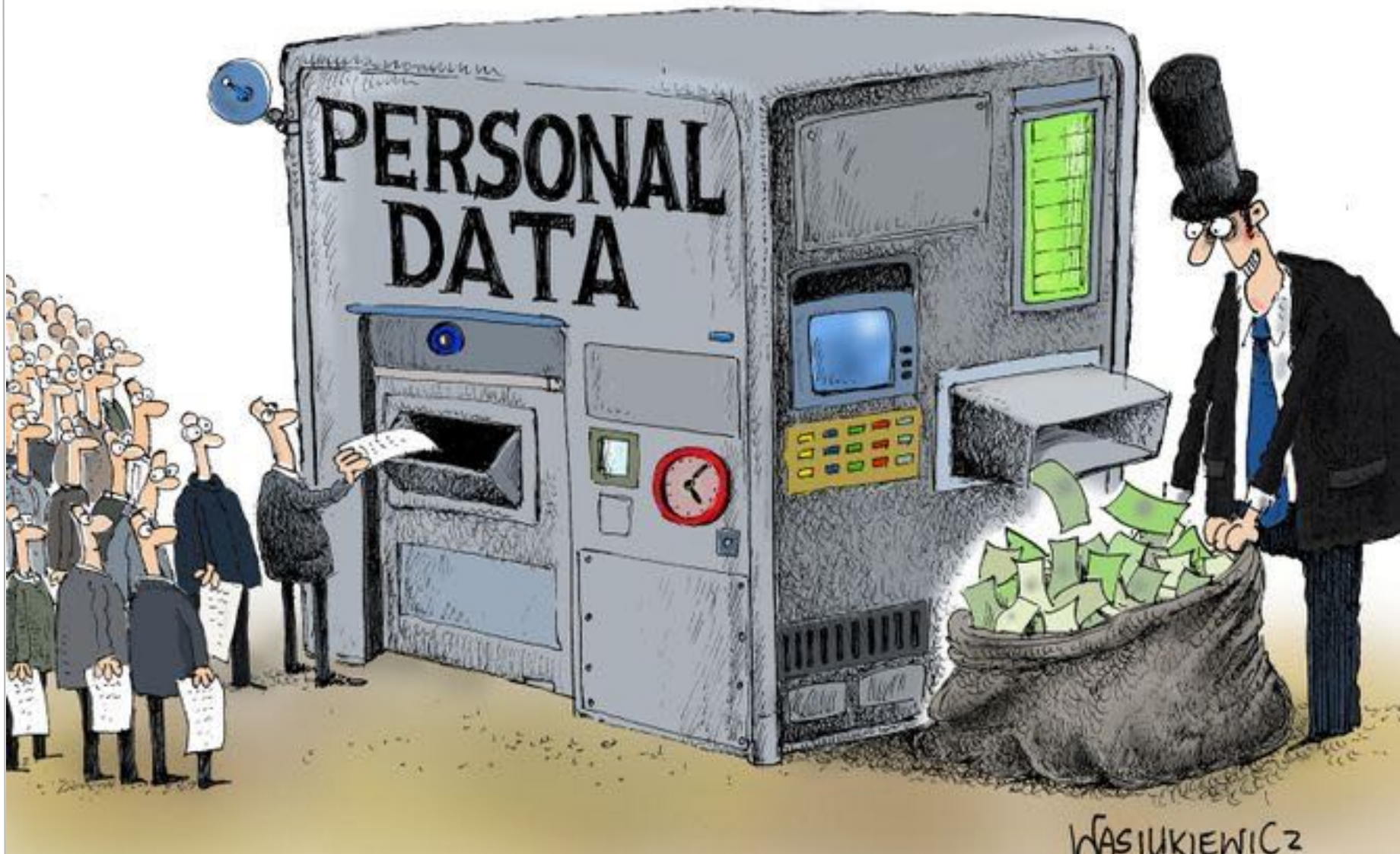
Walled gardens

We are trapped in
“app ecosystems”

Information silos

We don’t own our data

Why?



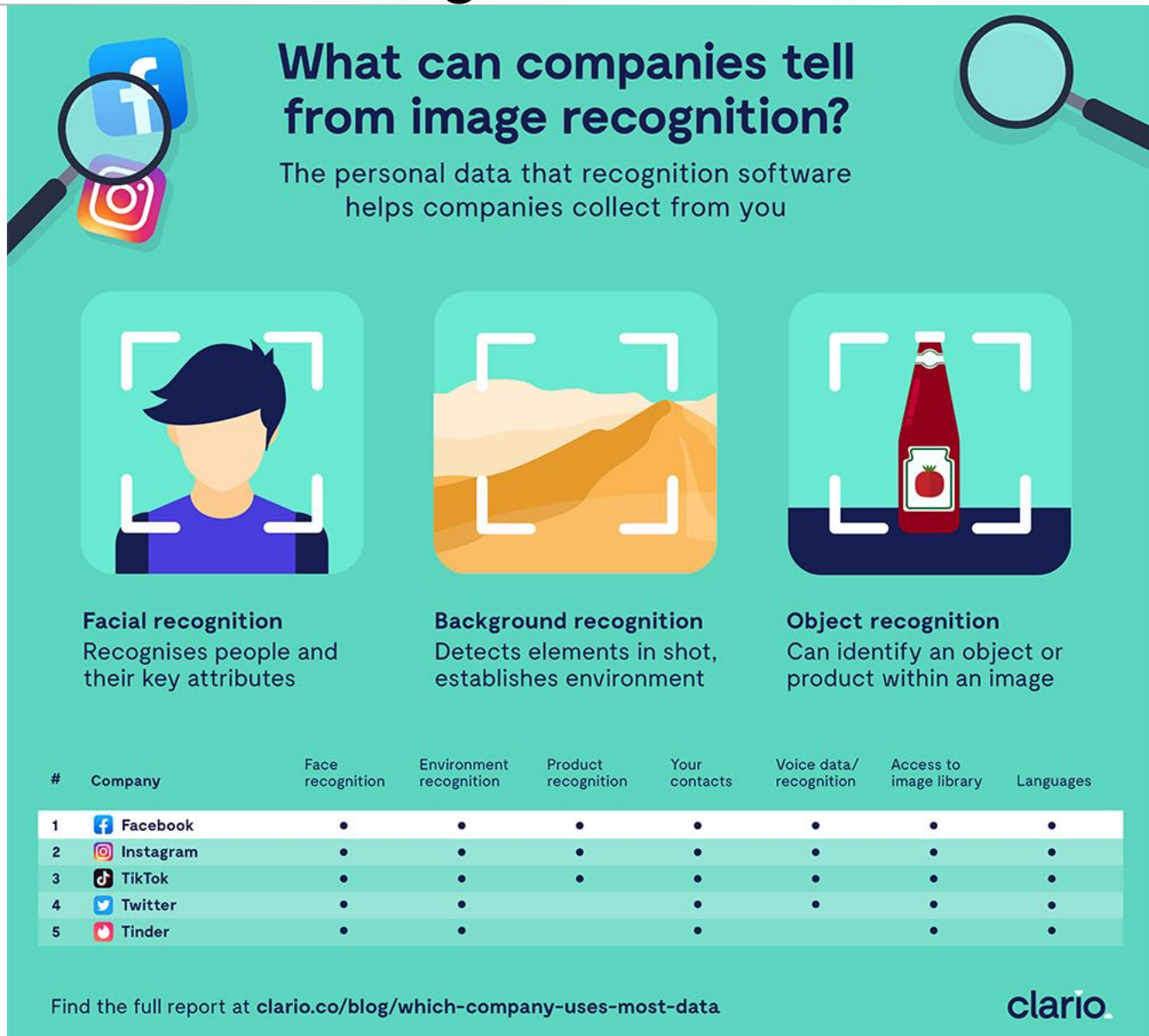
Personal data collection

https://clario.co/blog/which-company-uses-most-data/

BUT:

Google reads all your email!

Increased use of face recognition



#	Company	Face recognition	Environment recognition	Product recognition	Your contacts	Voice data/ recognition	Access to image library	Languages
1	Facebook	•	•	•	•	•	•	•
2	Instagram	•	•	•	•	•	•	•
3	TikTok	•	•	•	•	•	•	•
4	Twitter	•	•		•	•	•	•
5	Tinder	•	•		•		•	•

Has also access to the audio of video calls

Ad-based business model

Meta

Facebook income in 2020:

$84.2 billion - **98% from ads**

$32.6 billion profit

38% profit margin

Apple (2020):

$209 billion income

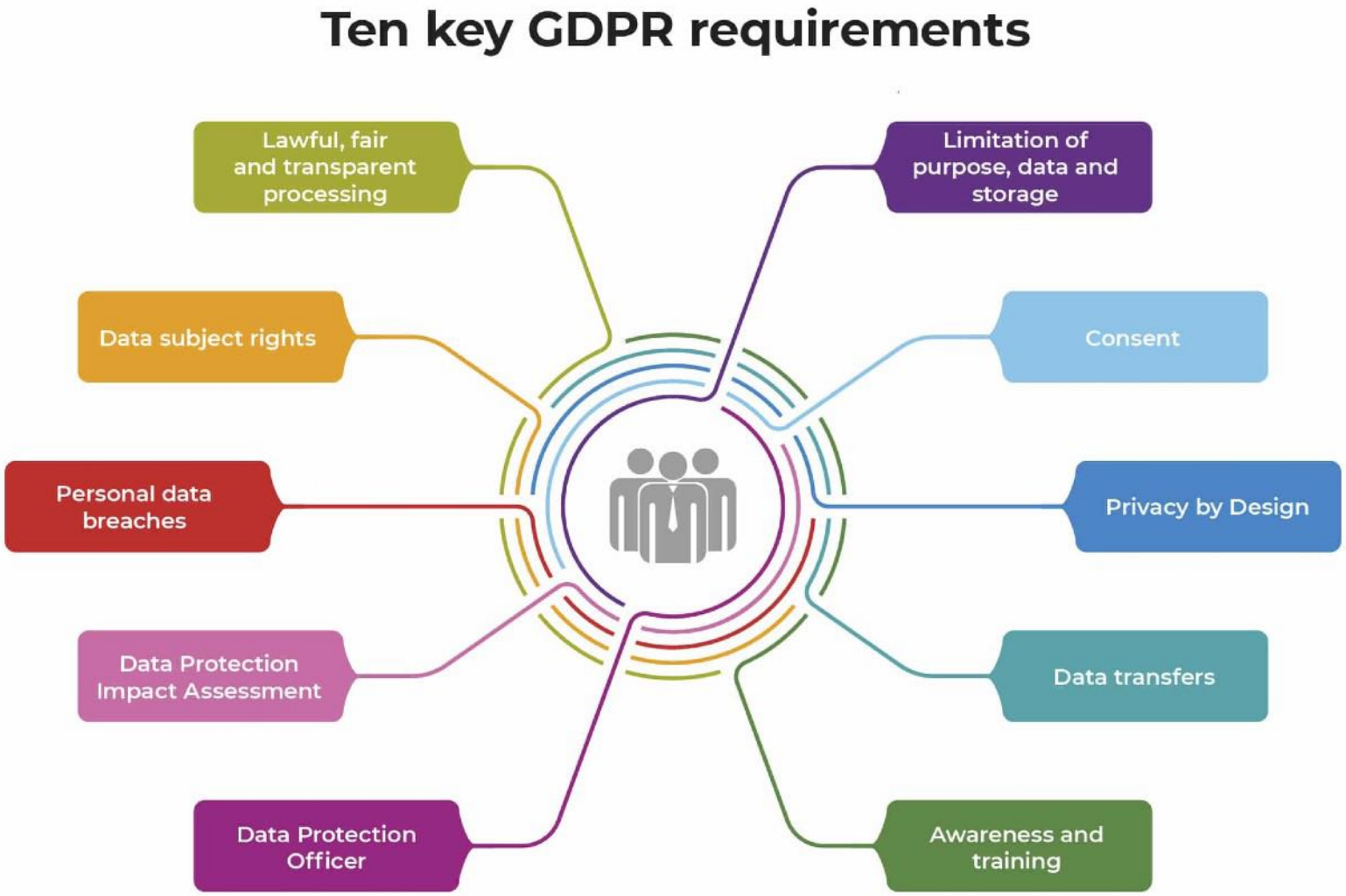
$80 billion profit

38% profit margin

Facebook/Meta has about 3 billion users.

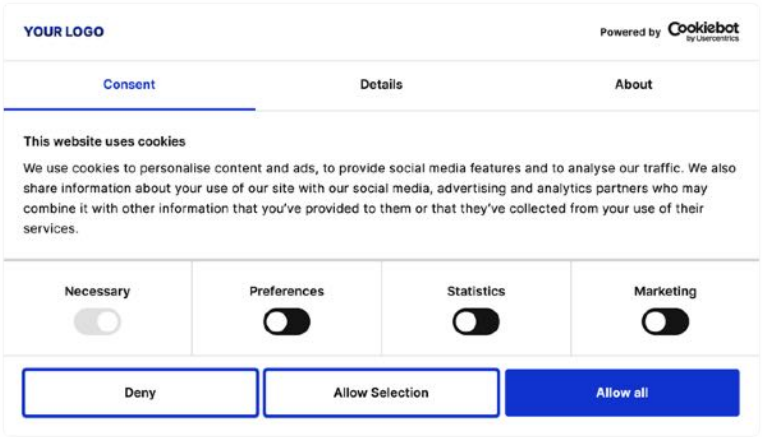
If each user paid $30 per year ($2.50 per month) to be able to use Facebook, Instagram, WhatsApp, Facebook/Meta would generate the same income

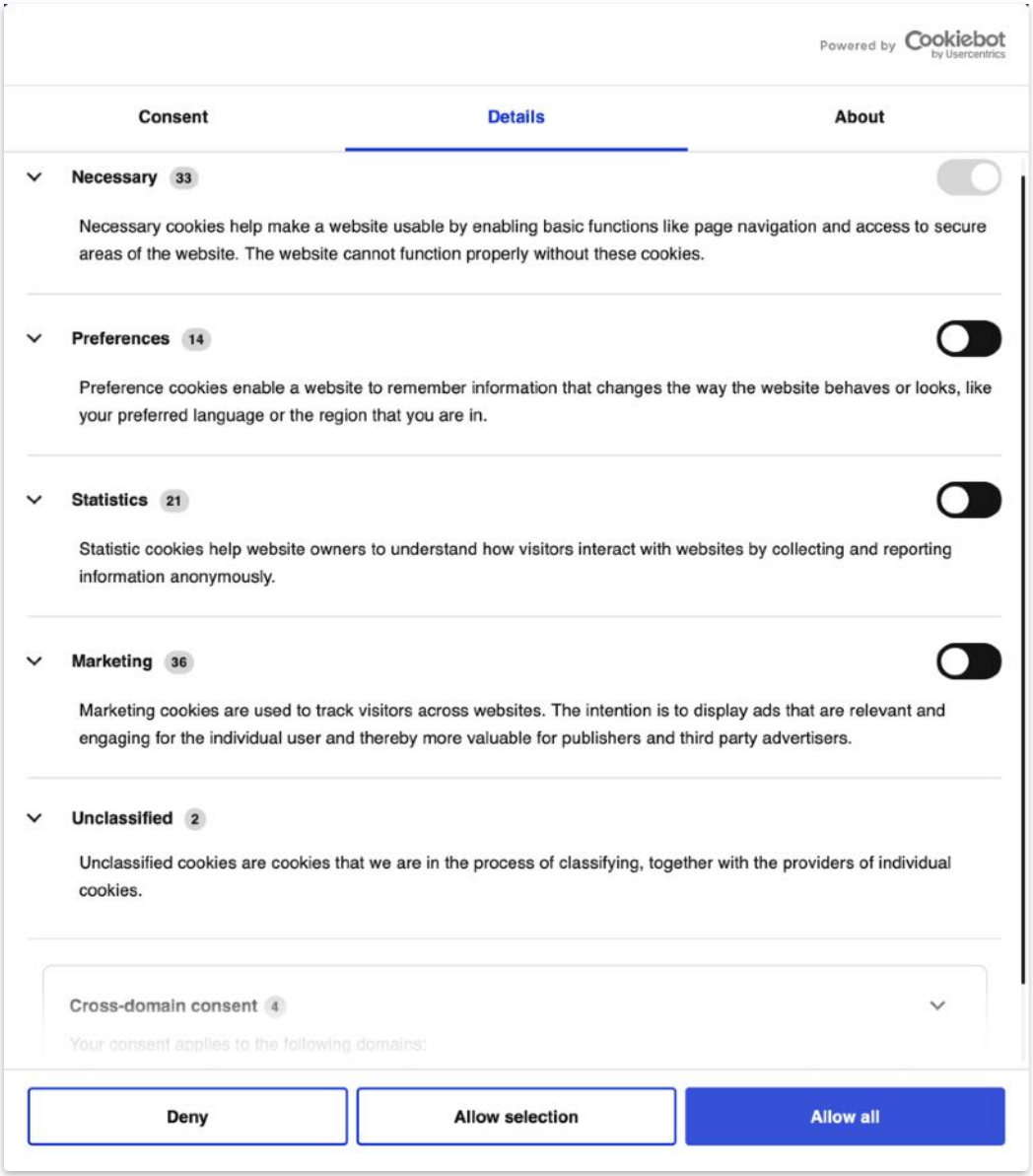
GDPR - General Data Protection Regulation



“Informed” consent

Do you know what you consent to?

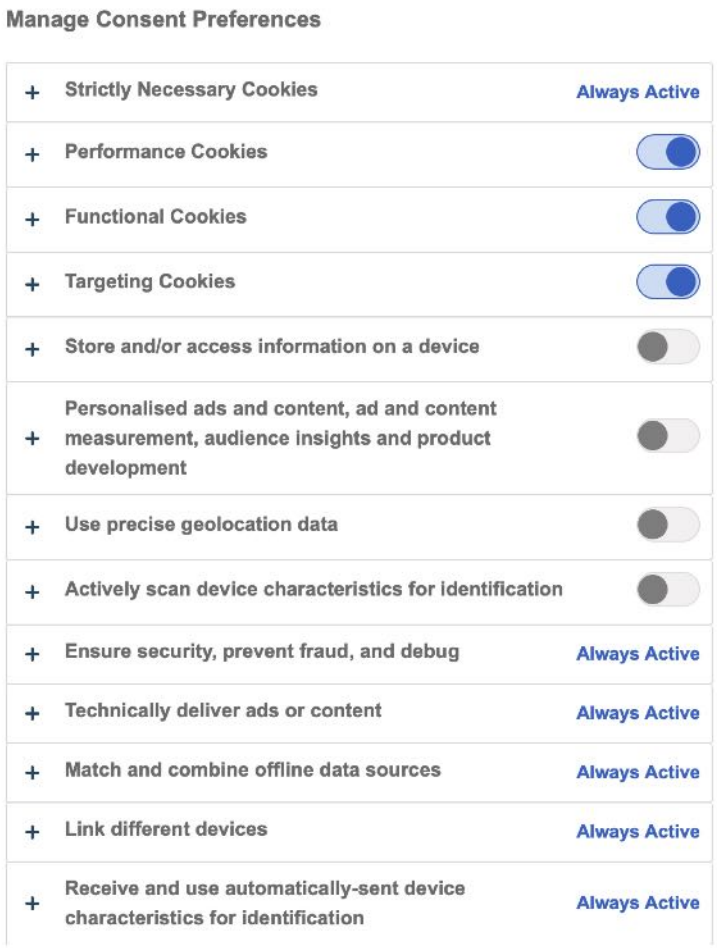


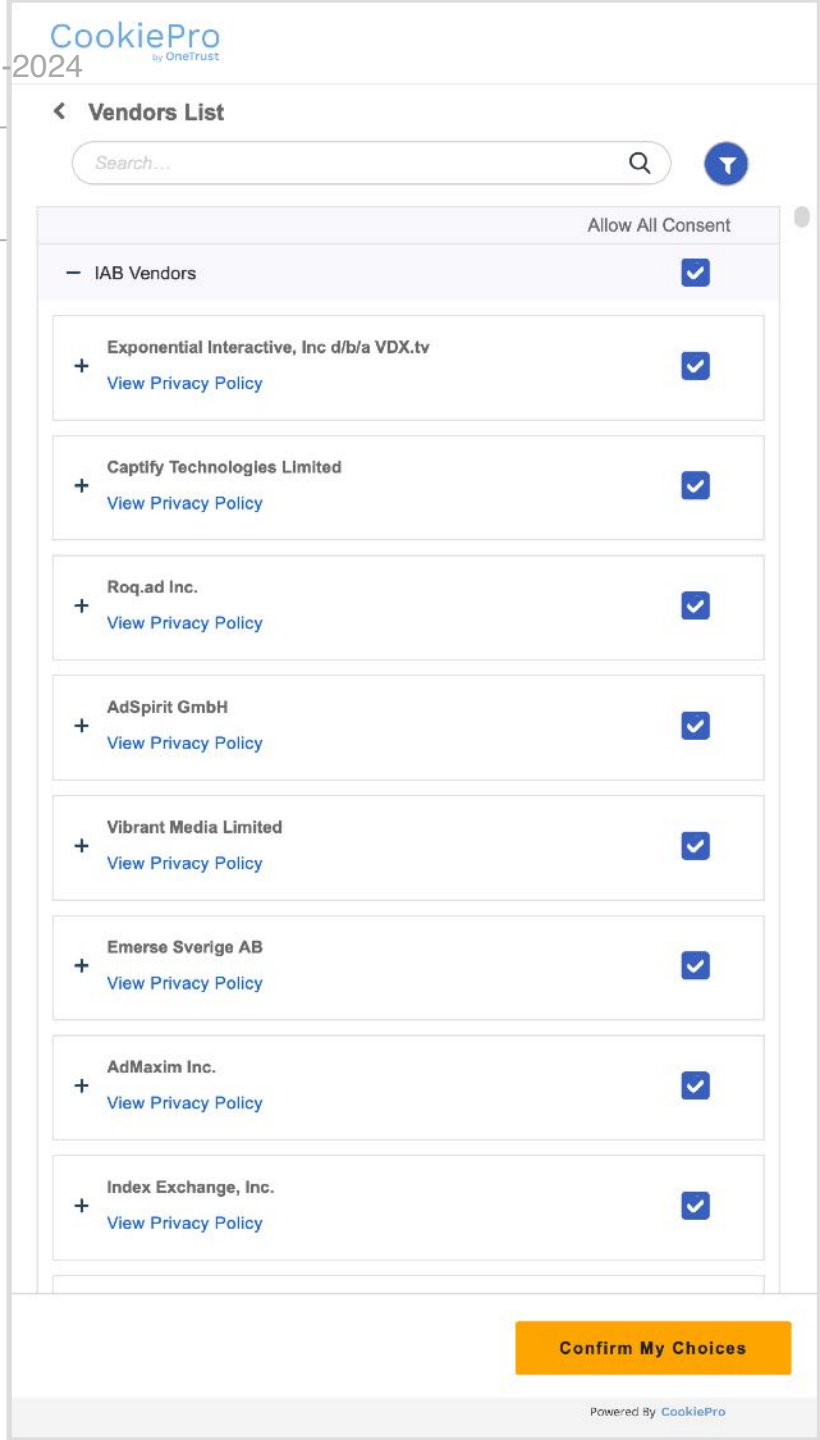


"Informed" consent

Example (investing.com):

more than 1600 vendors





Why is this relevant?

Collaborative computing
requires infrastructure to
mediate the collaboration

Whoever runs the infrastructure
controls
who can collaborate and how

This infrastructure becomes
a form of commons

Who should control it?
Under what rules?

What is Collaborative Computing?

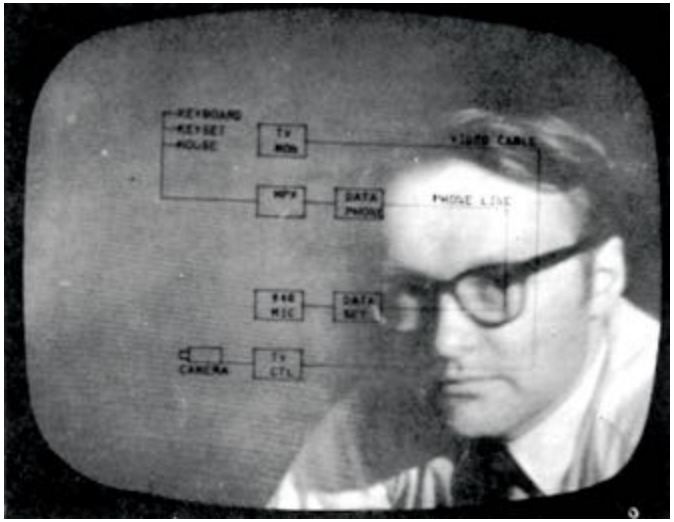
Don Norman

"Most work done on any complex entity is done by more than one person"

"Social impact of technology is hard to predict"

Augmenting the human intellect

1968 : Engelbart and his colleagues NLS/Augment,
a system that supported file sharing, personal annotations, electronic messaging, videoconferencing, screen sharing, telepointers, etc.



NLS / Augment - Douglas Engelbart (1968)

Emergence of a field

Started under the umbrella of “Office Information Systems”

Software that supports group work

- Groupware (Johnson-Lenz, 1982)
- Computer Supported Cooperative Work (Greif & Cashman, 1984)

In French:

- *Collecticiel*
- *Travail Coopératif Assisté par Ordinateur (TCAO)*

Conferences: CSCW (ACM) and ECSCW since 1986

Journal of CSCW

Social definition

CSCW should be conceived as an endeavor to understand the nature and characteristics of cooperative work with the objective of designing adequate computer-based technologies. [...]

The focus is to *understand,* so as to *better support,* cooperative work.

Bannon et Schmidt, 1989

Engineering definition

Computer-based systems
    that support
groups of people
    engaged in
a common task (or goal)
    and that provide
an interface to a shared environment

Ellis, Gibbs & Rein, 1991

Software definition

Groupware is distinguished from normal software
by the basic assumption it makes:
groupware makes the user aware that he is part of a group,
while most other software seeks to hide and protect users
from each other.

Lynch, Snyder & Vogel, 1990

Challenges

What should groupware systems do?

How to design them?

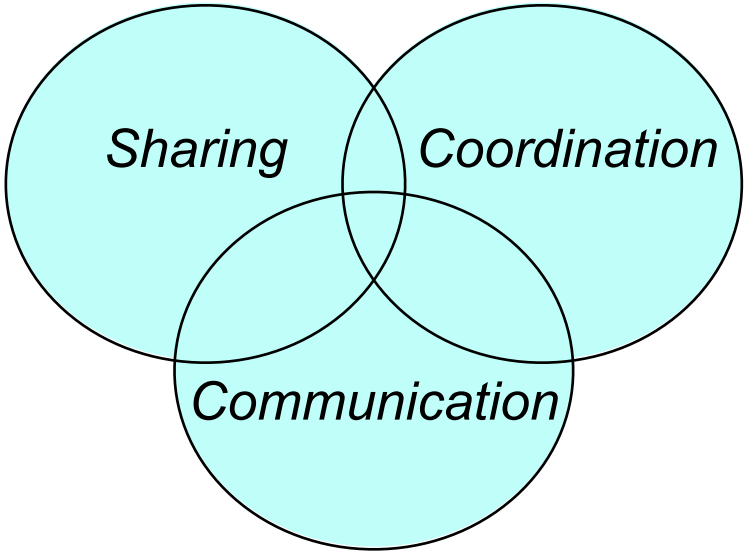
How do they affect use?

A multidisciplinary endeavor: sociology, ethnography, anthropology, design, computer science, etc.

Problems are both technical and human

Solutions are both technical and human

Functional taxonomy



Communication
exchanging information among participants

Sharing
accessing and editing digital artifacts

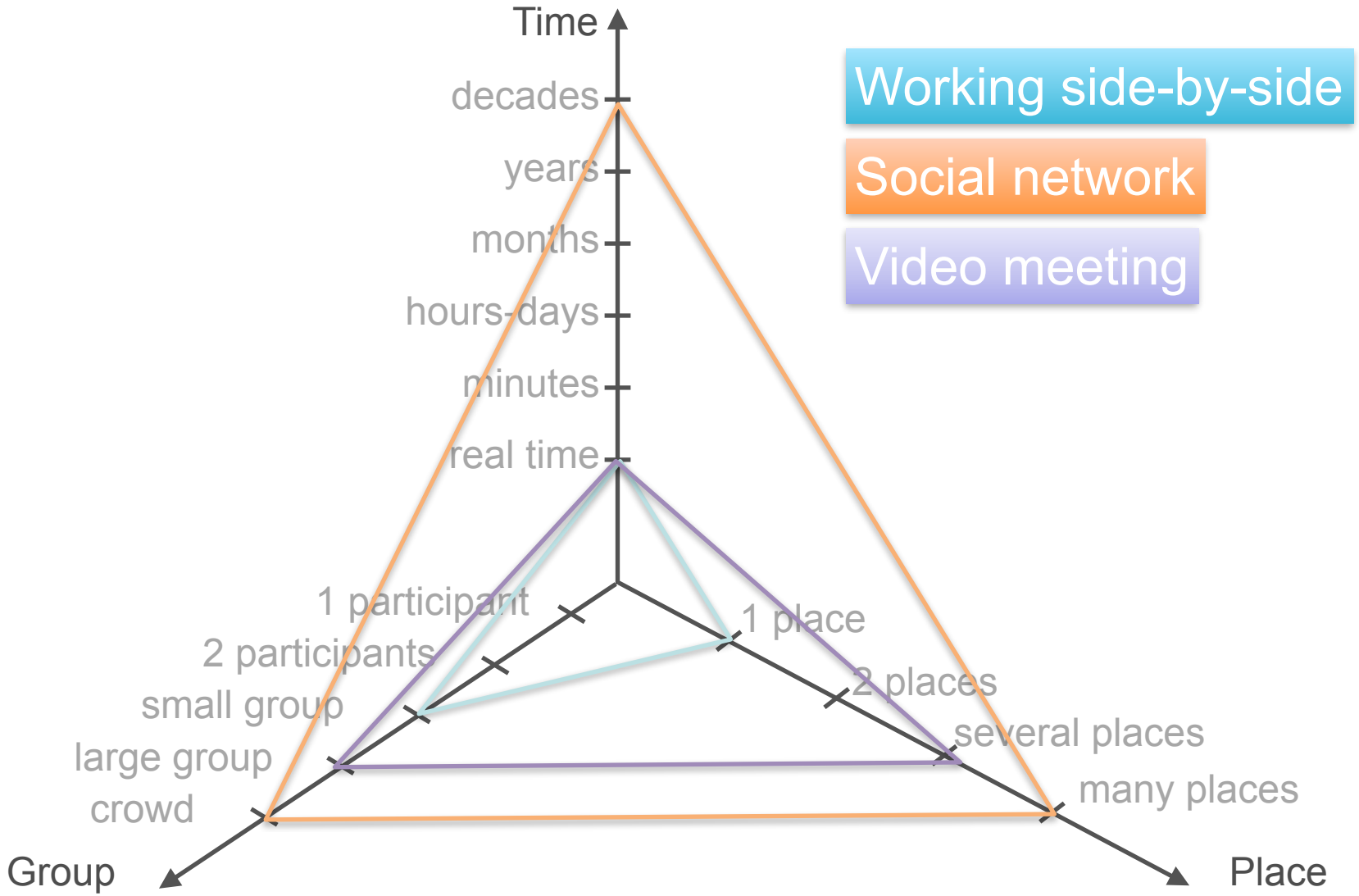
Coordination
division of labor among participants

Space-time matrix

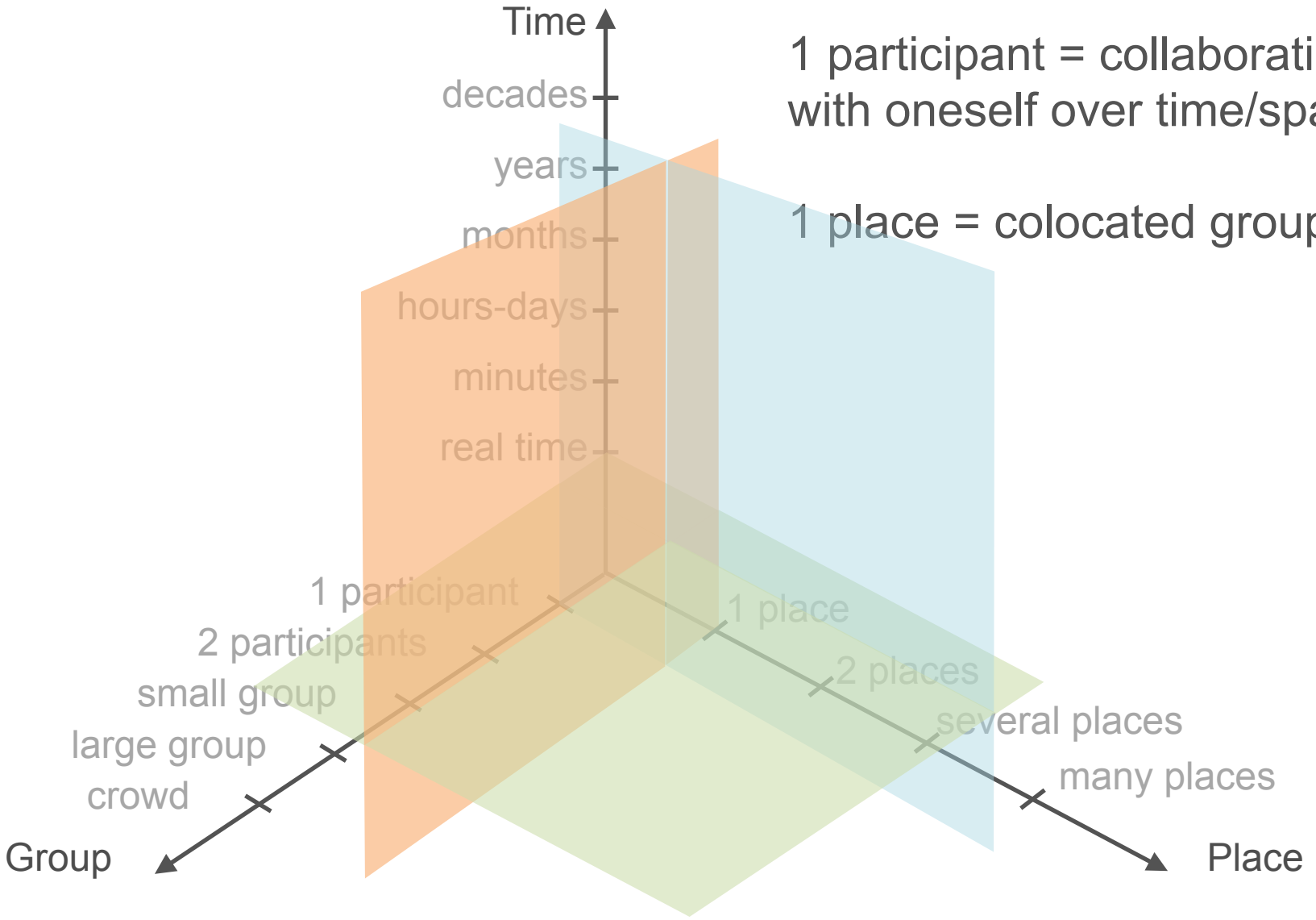
Johansen, 1988

	Same place	Different place
Same time	face-to-face conversation	telephone call
Different time	Post-it note	letter

Group-time-space continuum



Group-time-space continuum



1 participant = collaborating with oneself over time/space

1 place = colocated group

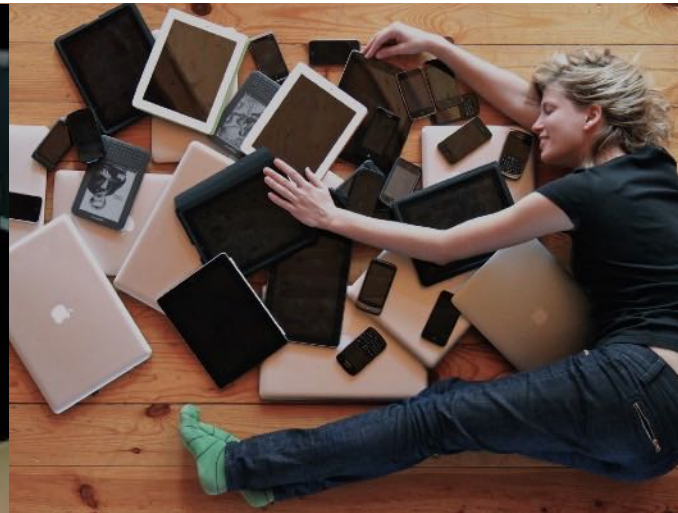
Scaling is difficult

Another dimension: devices

There are usually more devices than people

Collaboration with oneself across our devices

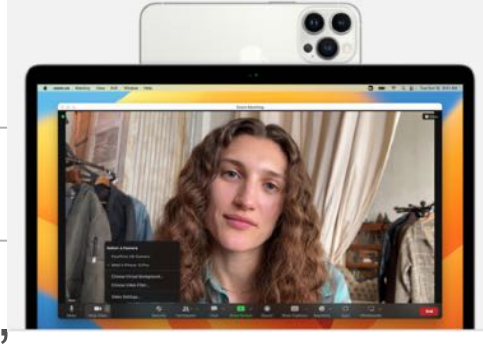
Making devices “collaborate” with each other



Apple Continuity

"All your devices, one seamless experience"

- Use iPhone as camera
- Use mouse/keyboard for tablet
- Use tablet for desktop
- AirPlay between devices
- Get messages across devices
- Unlock screen with watch
- Answer call on desktop
- Airdrop files across devices
- Copy-paste across devices
- Start editing on one device, finish on another
- Use phone as hotspot
- …



Collaboration is fluid

During the course of a collaborative activity,
the mode of collaboration changes, sometimes quickly

- from real time to different time
- from sharing to communicating to coordinating
- from tight coupling to loose coupling
- from everyone together to hybrid to fully remote

BUT most software do not address these transitions

A sample of collaborative systems

Share

Colab

Stefik et al., 1987

Meetings of small group in a specially-equipped room

"Shared external memory"

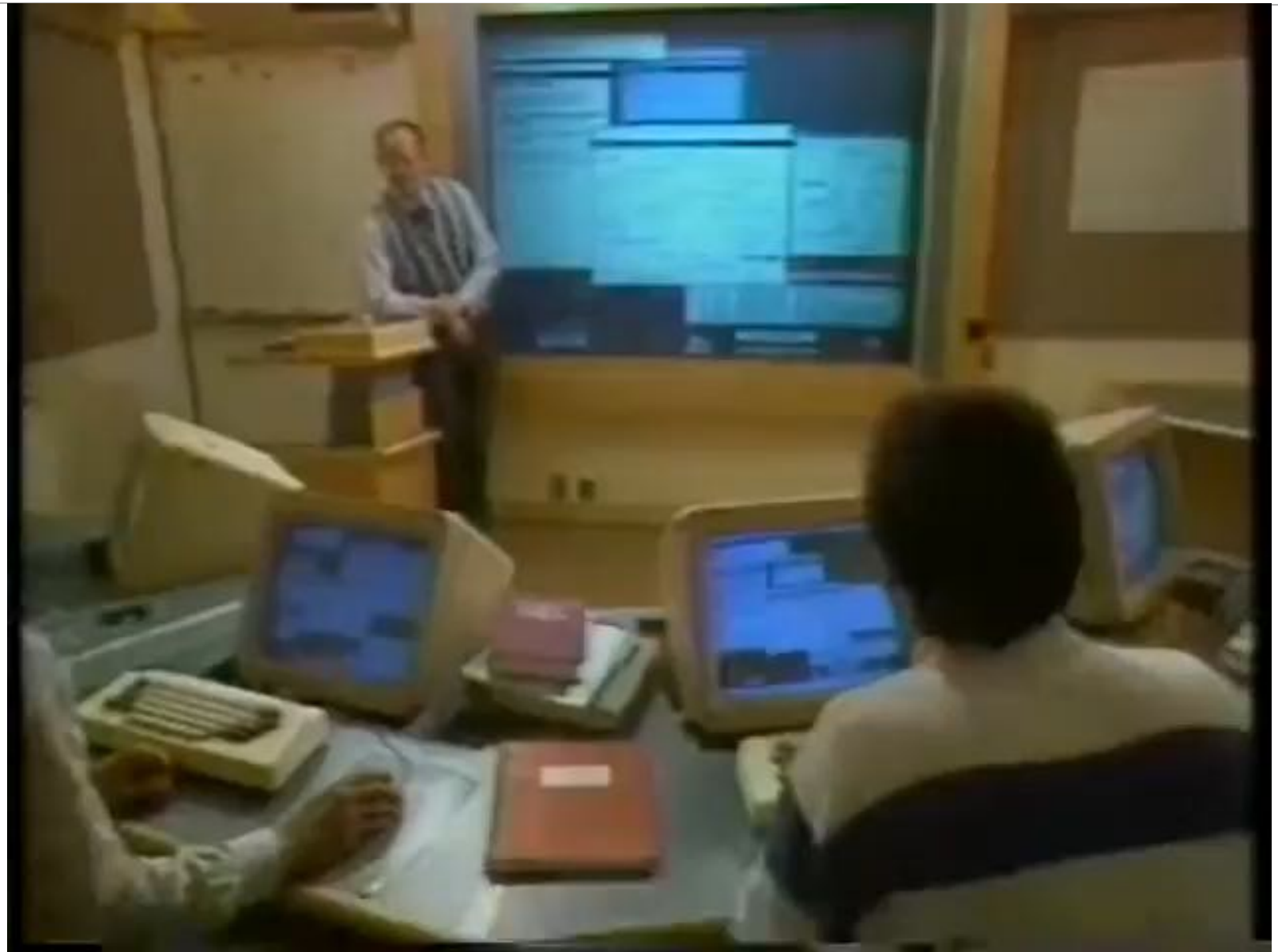
- Boardnoter : hand drawing
- Cognoter : outlining ideas
- Argnoter : argumentation spreadsheet

View, space and time congruence

- What You See is What I See
- What You See Is Almost What I See

Colab

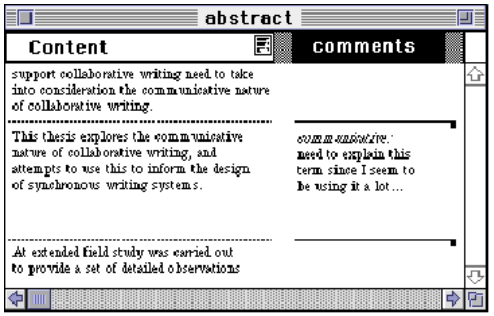
Stefik et al., 1987



Shared editing

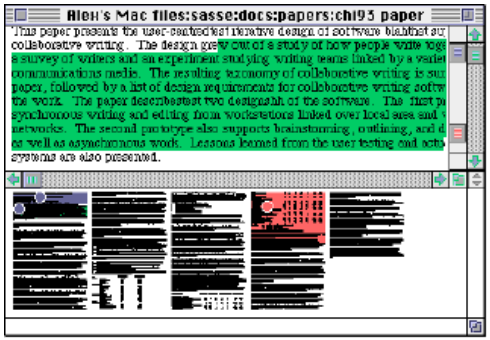
Text, asynchronous

- Quilt (Leland, Fish & Kraut, 1988)
- Prep (Neuwirth et al., 1989)



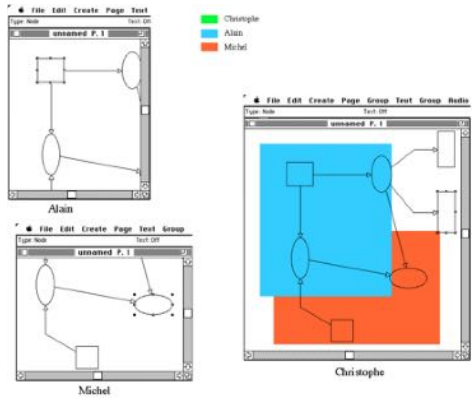
Text, synchronous

- Grove (Ellis, Gibbs & Rein, 1989)
- ShrEdit (McGuffin & Olson, 1992)
- SASSE (Baecker et al., 1993)

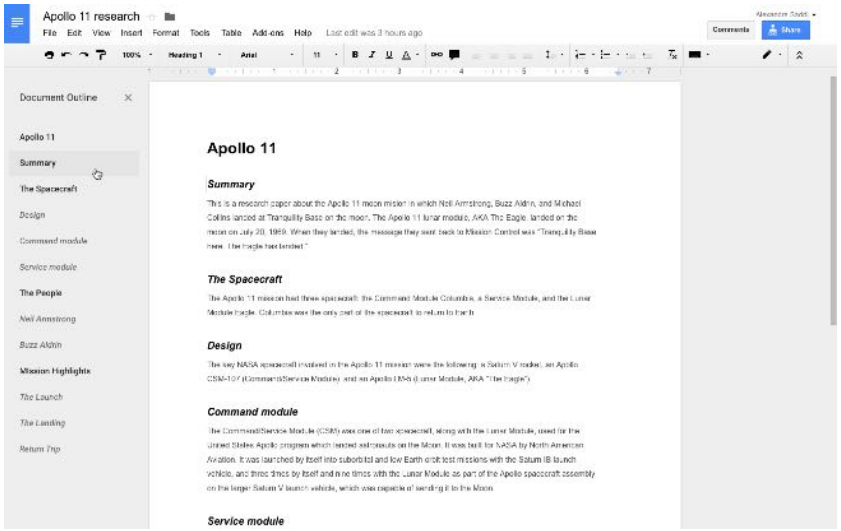


Graphics, synchronous

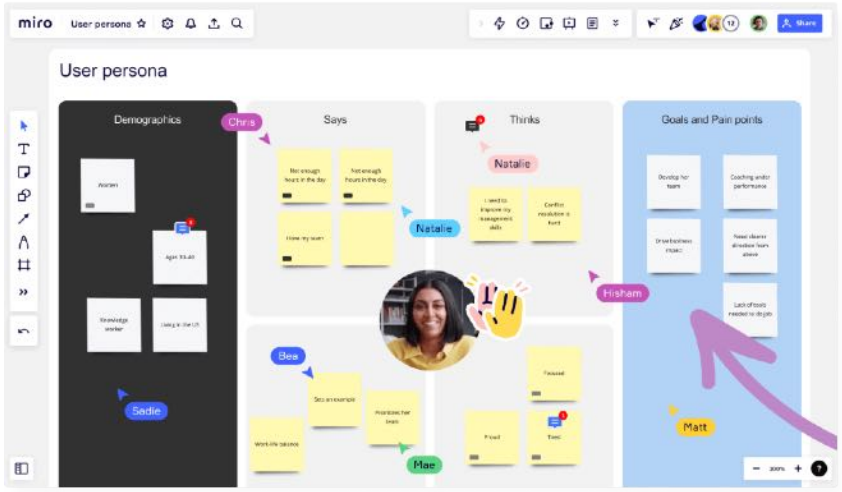
- GroupDesign (Karsenty & Beaudouin-Lafon, 1992)



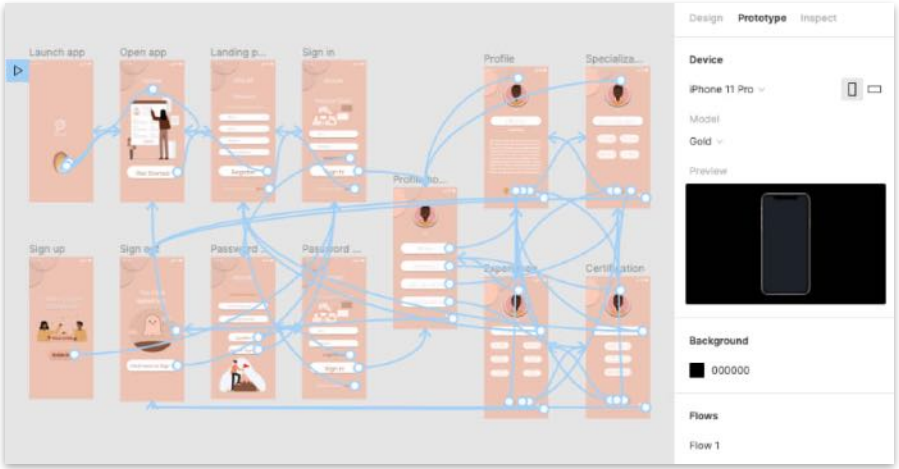
Web-based shared editing is now common



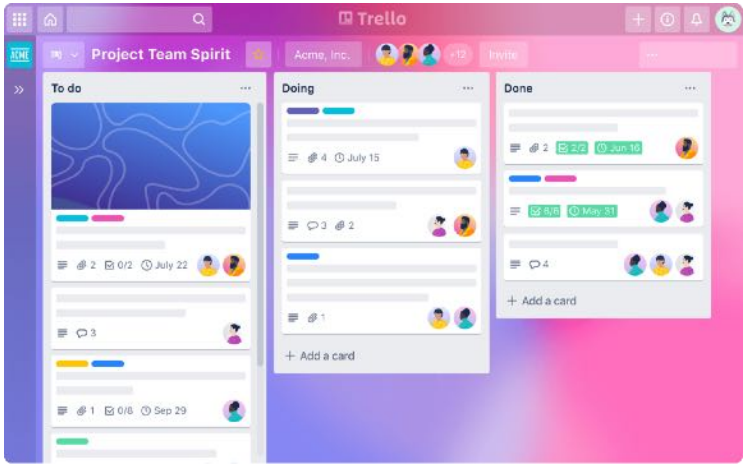
Google docs



Miro



Figma

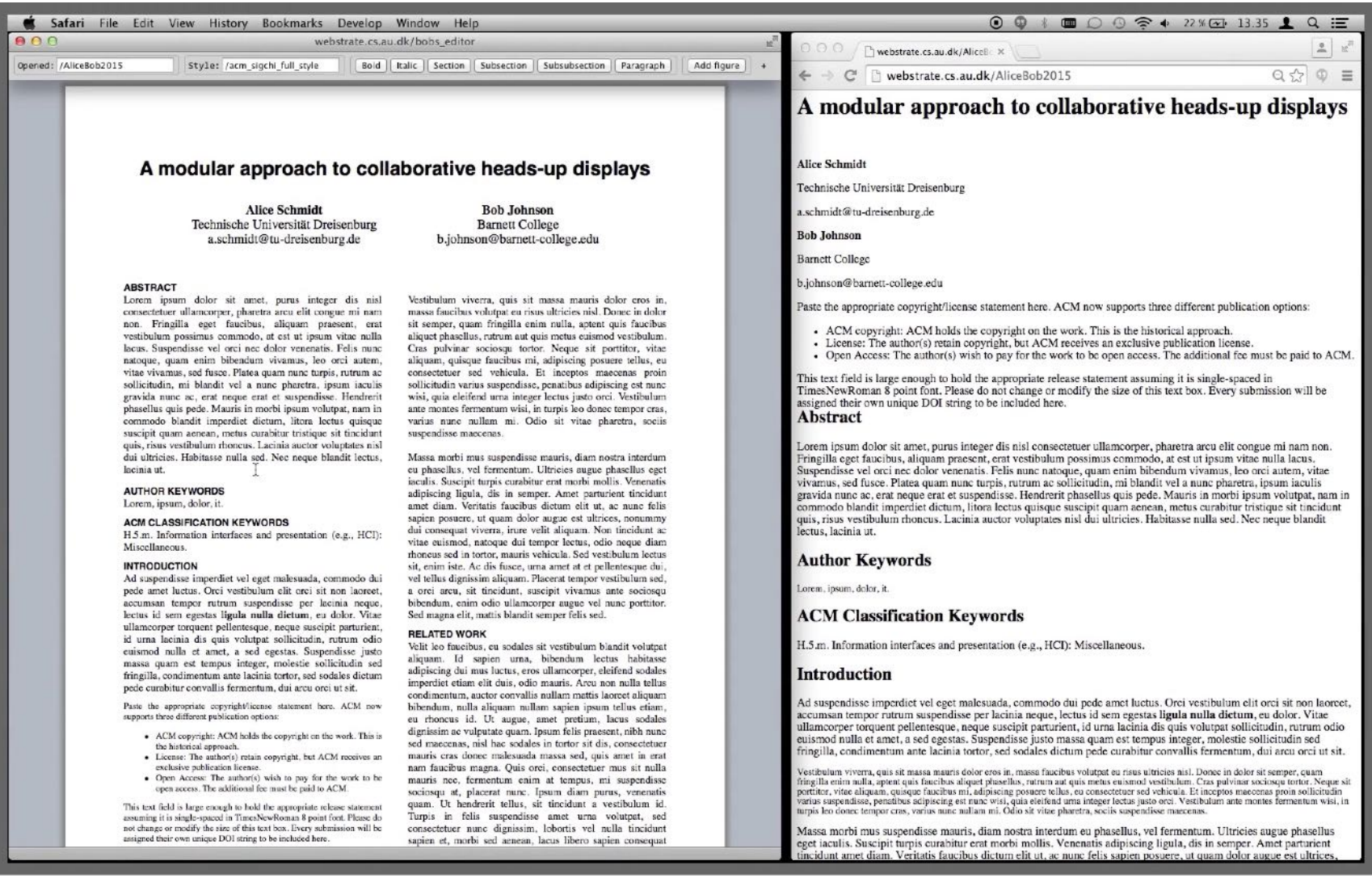


Trello

Webstrates

Klokmose, Eagan, Baader, Mackay, Beaudouin-Lafon, 2015

2X



Tabletop interaction

DiamondTouch (Dietz et al., 2001)

- Interactive multitouch table
- Participant identification

DiamondSpin (Shen et al., 2004)

- User interface toolkit for tabletops

Reactable (Jordá et al., 2005)

- tangible interaction

Coordinate

Information lens

Malone et al., 1987

Rule-based processing of email

"**if** email from mbl@lri.fr **and** subject includes Master **then** file under Courses/Groupware"

To:
From: Thomas Malone
Cc: Anyone
Subject : LENS Meeting This Monday
Topic : Lens
Day: Monday
Meeting Date: Time: 3:00
Place: E53-301
Text:

Workflow systems

Managing a document across an organization

Example : a document includes metadata describing its path through an organization

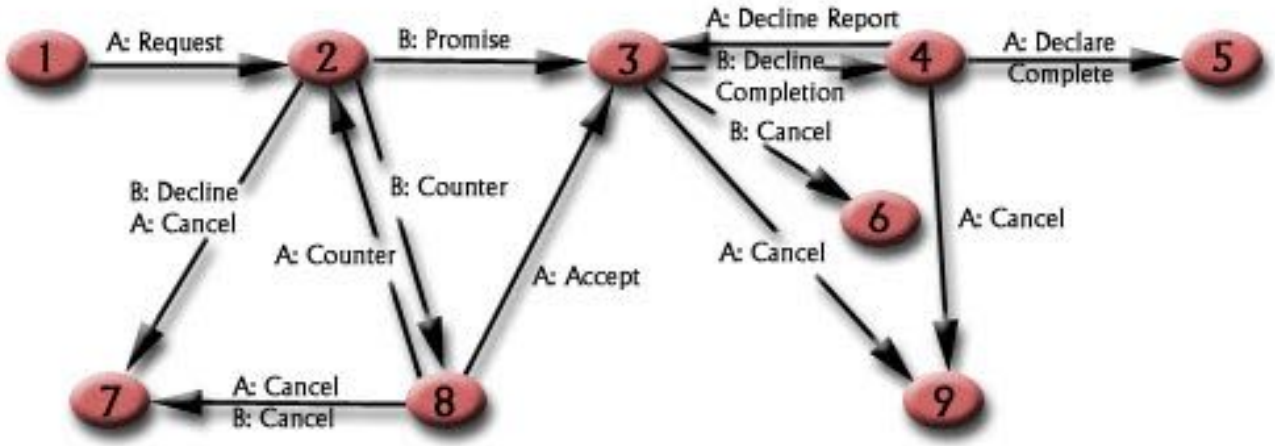
- must be written by Anne by April 15
- must be proofread by Bob by April 22
- must be approved by Charlie by April 29
- must be sent to Charlie by May 4

The document "knows its way"
and can send reminders
to the various people involved

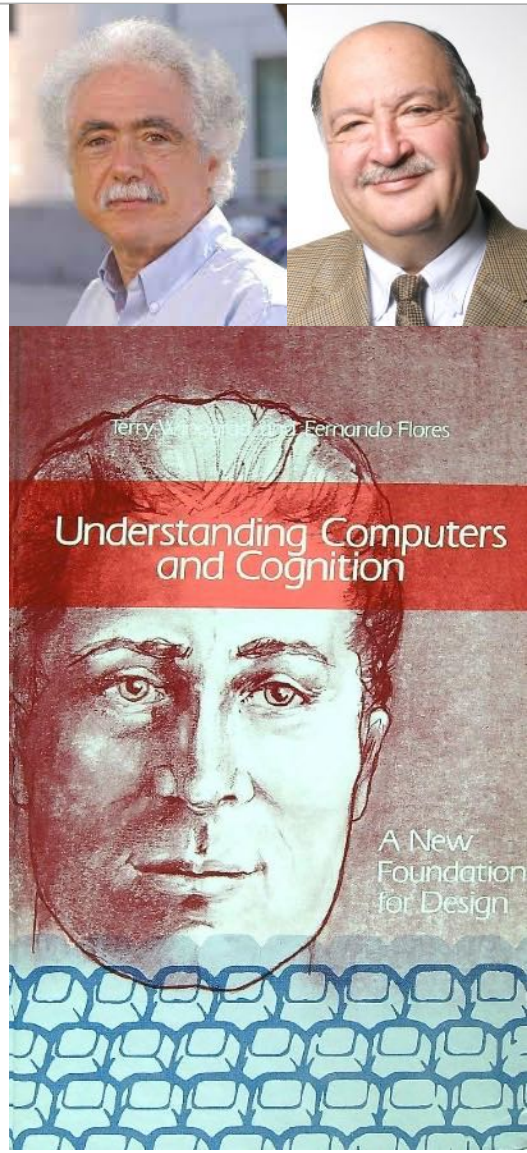
The Coordinator

Winograd & Flores, 1988

Based on the theory of speech acts (Searle)



Critique by Lucy Suchman

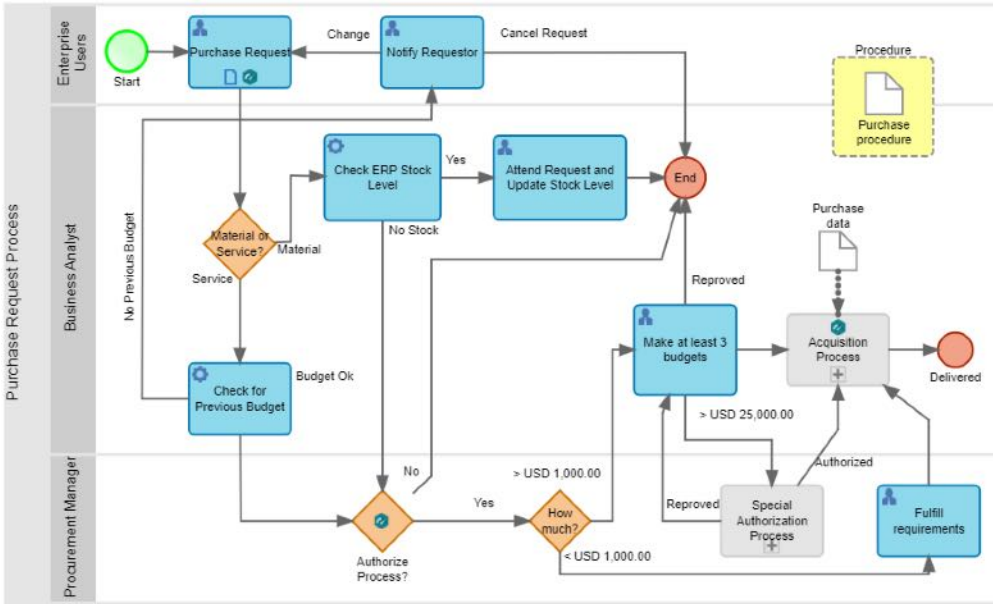


Business Process Management (BPM)

Optimize enterprise processes
Automate where possible

Large companies: SAP, SalesForce

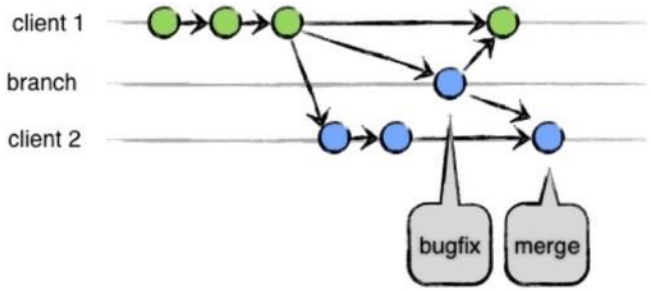
Modern form of Taylorism:
Humans must conform
to the processes

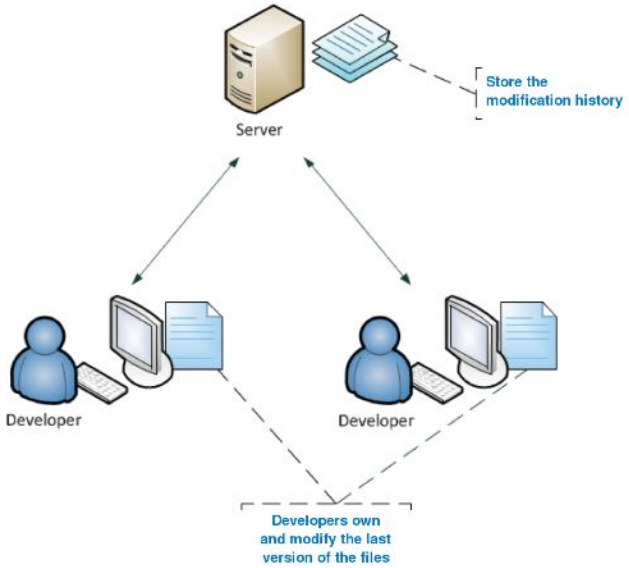


Collaborative software development

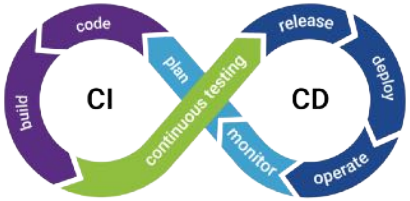
Manage complex software system development

Version control

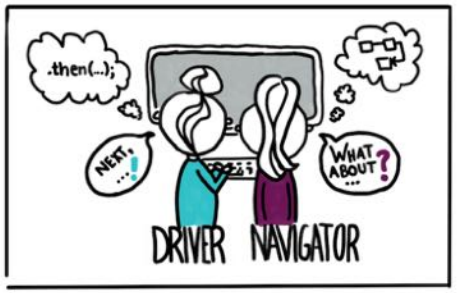




Continuous integration

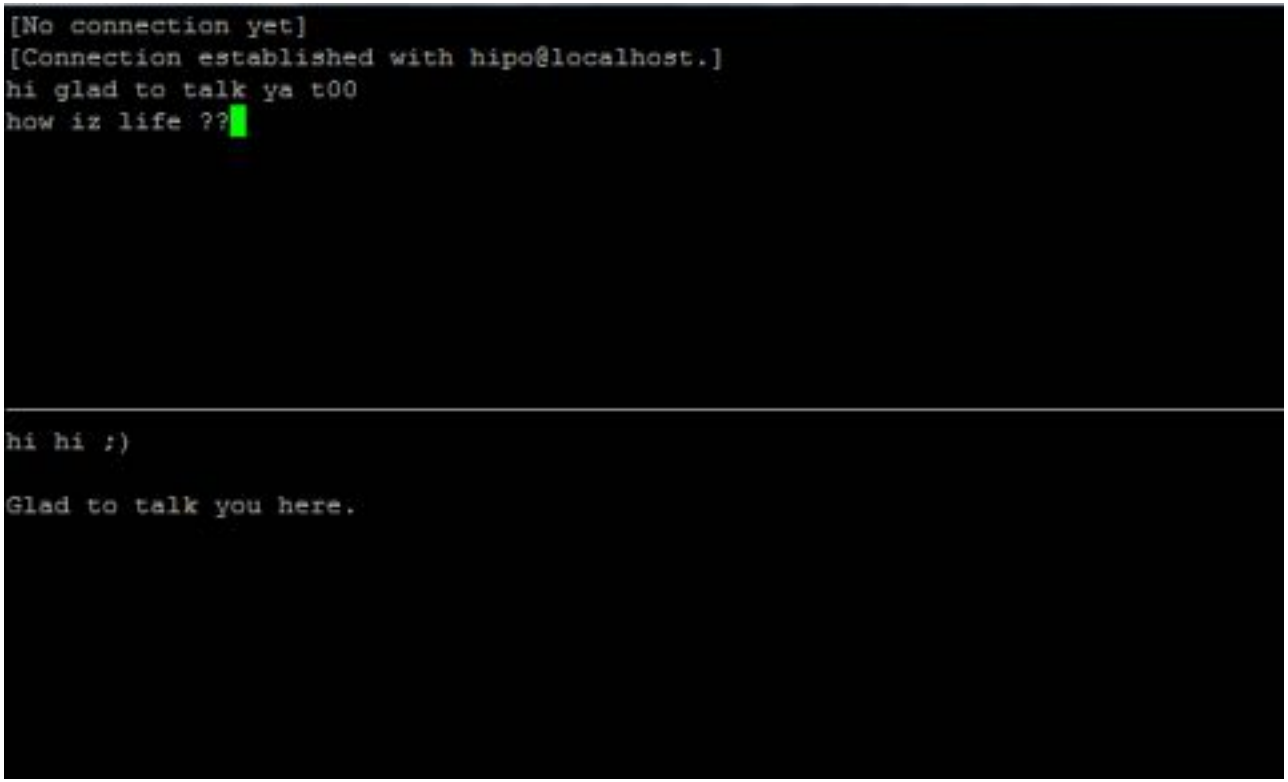


Agile development methods



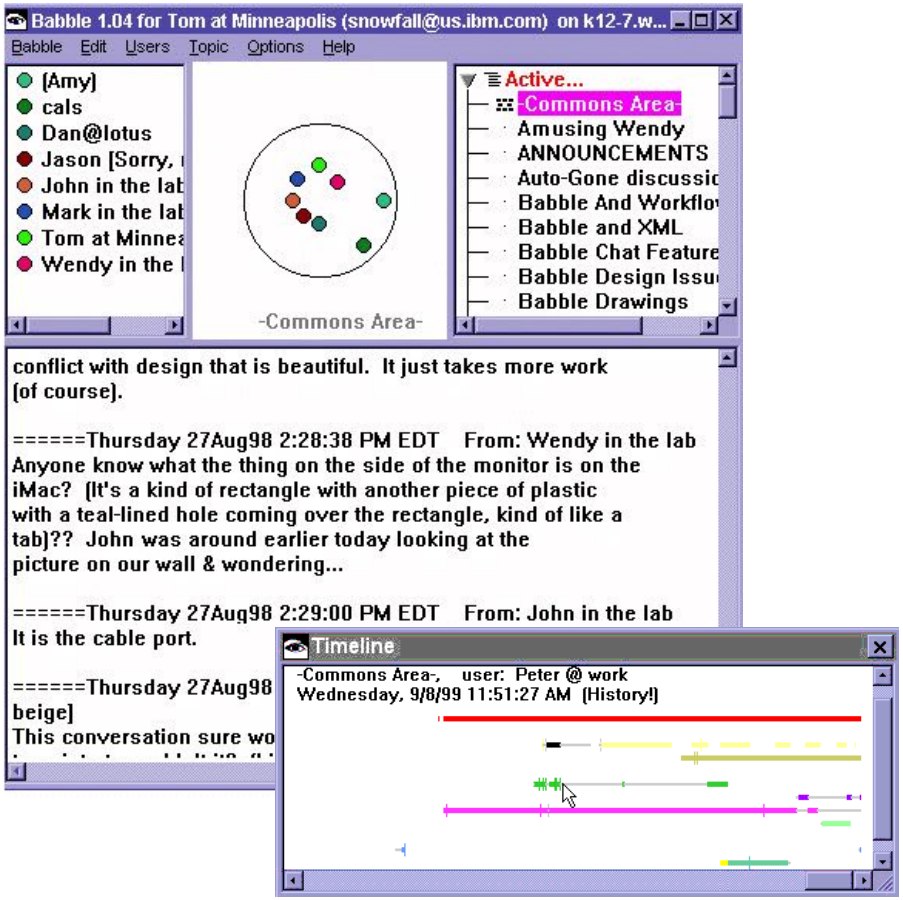
Communicate

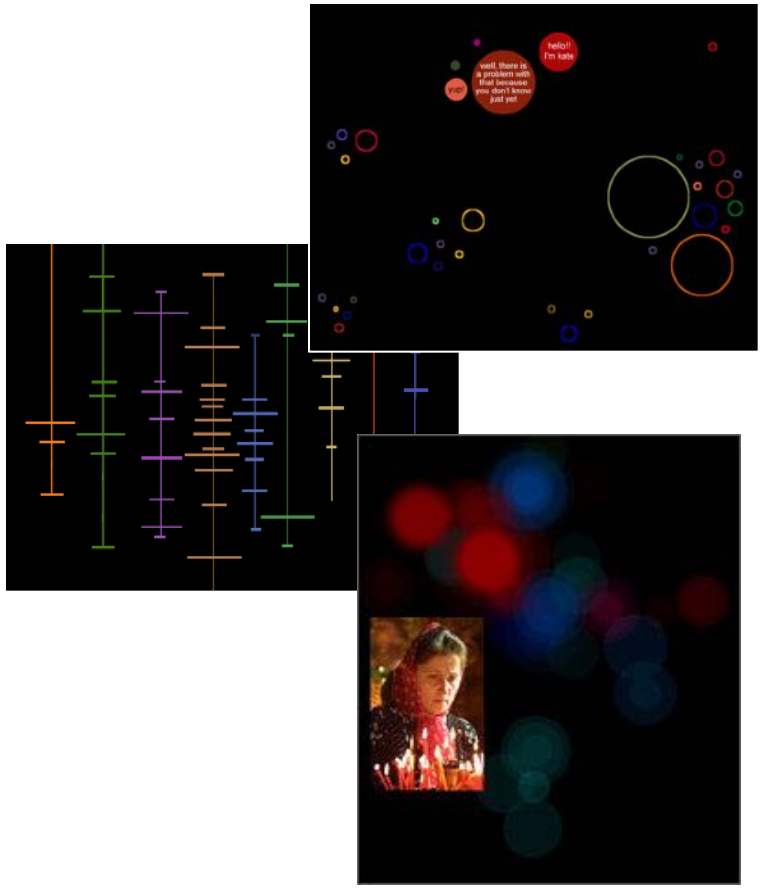
Text-based real-time communication



Unix talk

Chat rooms: for small groups





Babble (Bradner et al., 1988)
http://www.research.ibm.com/SocialComputing/babble.htm

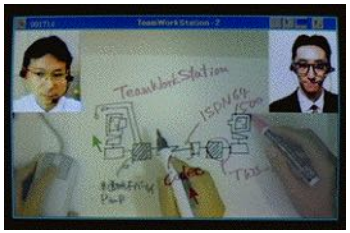
Chat circles (Viégas et al., 1999)
http://web.media.mit.edu/~fviegas/circles/
http://web.media.mit.edu/~fviegas/CC2/

Video-mediated communication

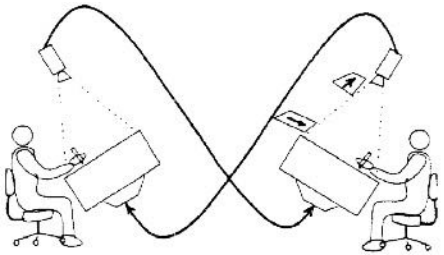
Hole-in-Space (1980)

Mediaspaces (1983-)

TeamWorkStation (1990)



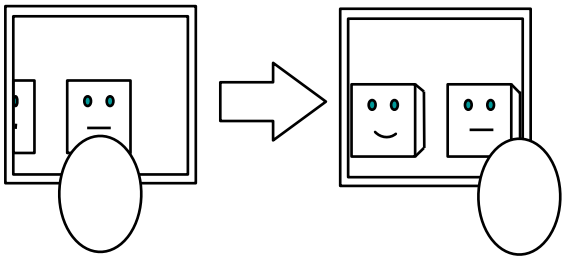
VideoDraw (1991)



ClearBoard (1991-94)

Videoplace (1974-85)

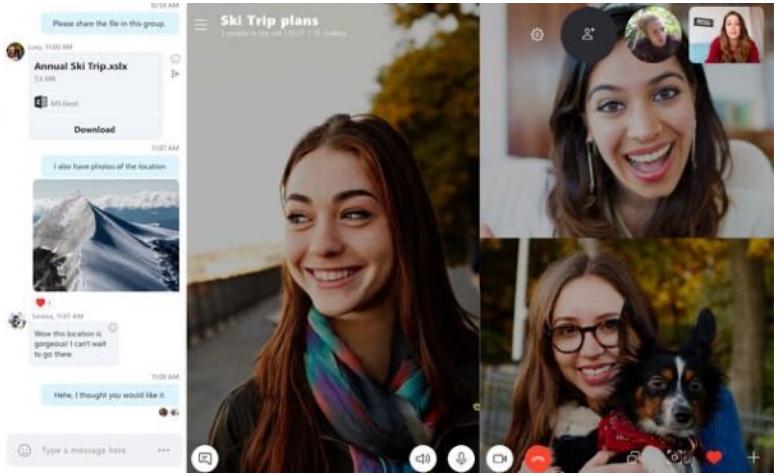
Virtual window (1995)



Clearboard

Ishii et al., 1992

Videoconferencing: all the same



Skype

Zoom

Teams

Webex

Social networks: scale up

Social networks: scale up

From small, “intimate” social networks to large groups of “followers”

- Explosion of the number of users

Shift towards pushing information to sustain “engagement”

- for better (Arab springs, …)
- and for worse (fake news, harassment, …)

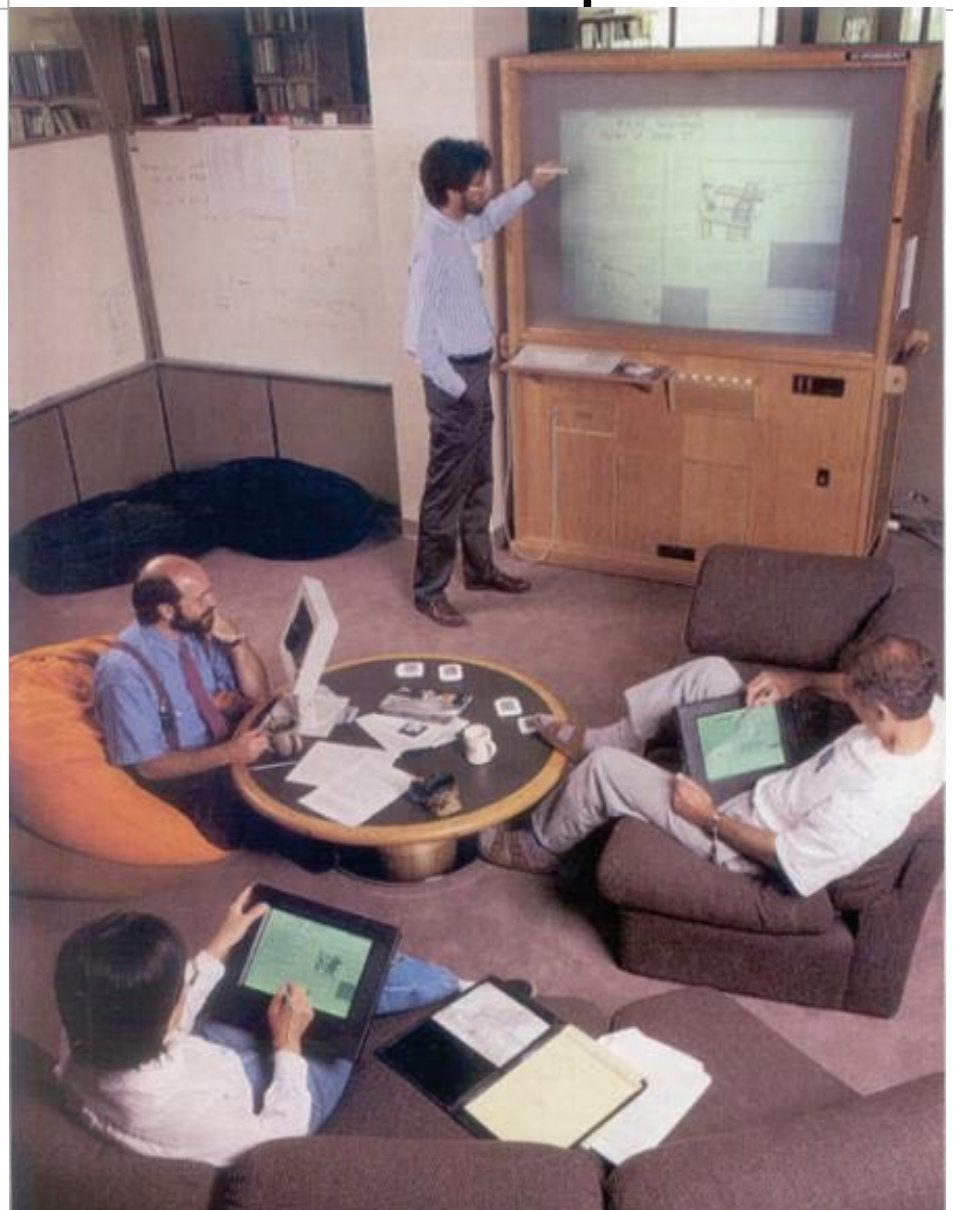
The fight for user attention to sustain the business model

- Large-scale experiments without informed consent
- Evidence that social media affects teens’ self-esteem

Regulate, but how?

Collaborate

Collaborative spaces



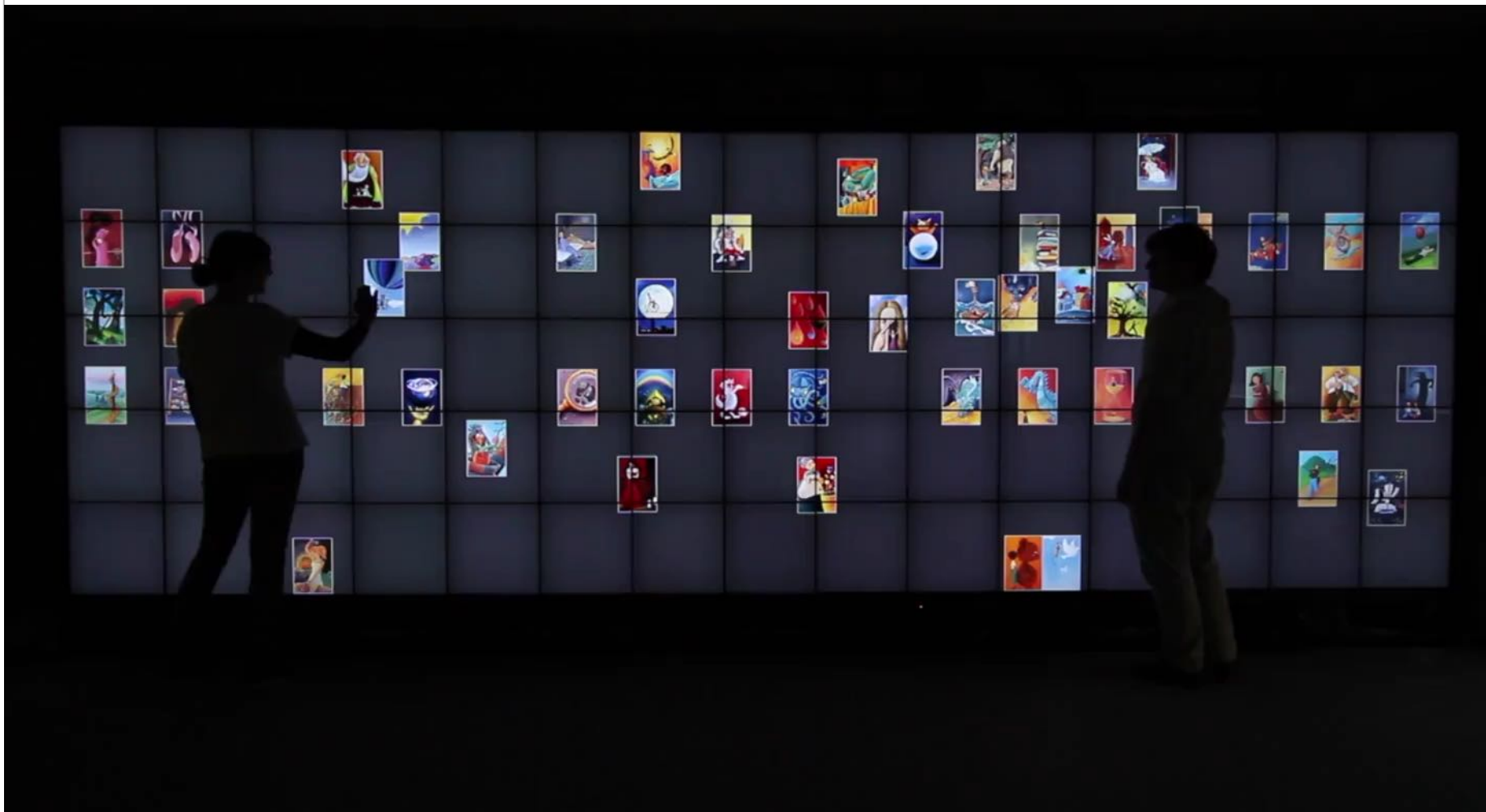
Cooperative buildings
(Streitz et al., 1998)

Ubicomp (Weiser, 1991)

Interactive spaces

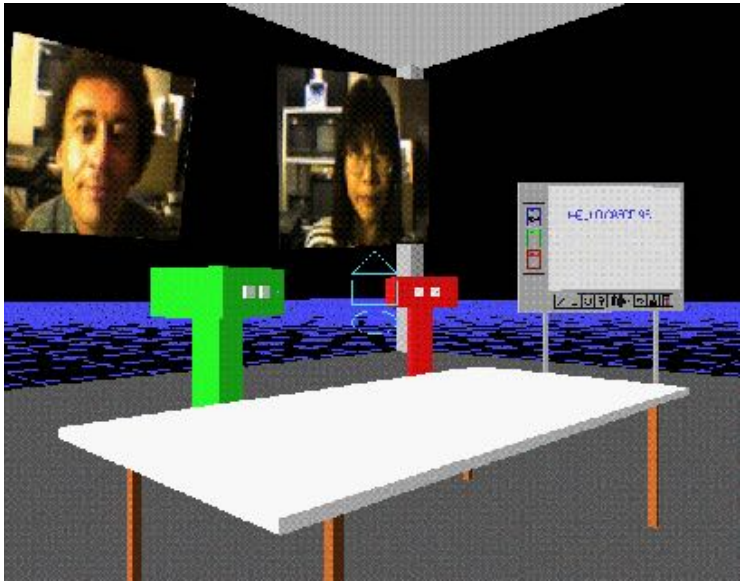
Collaborate on a wall-sized display

CoReach: collaborative gestures (Liu et al., 2017)



Collaborative Virtual Environments

Represent participants by avatars in a virtual world



DIVE (1991)

Second Life (2005)

Networked games

Real-time massively multiplayer games

World of Warcraft (2004)

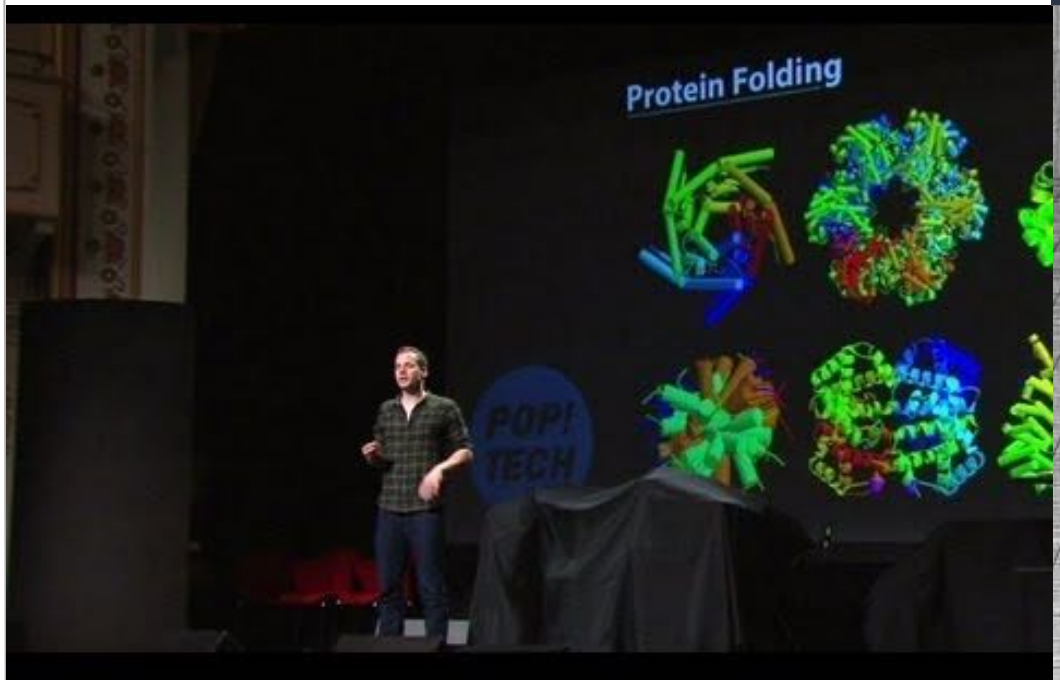
Fortnite (2017)

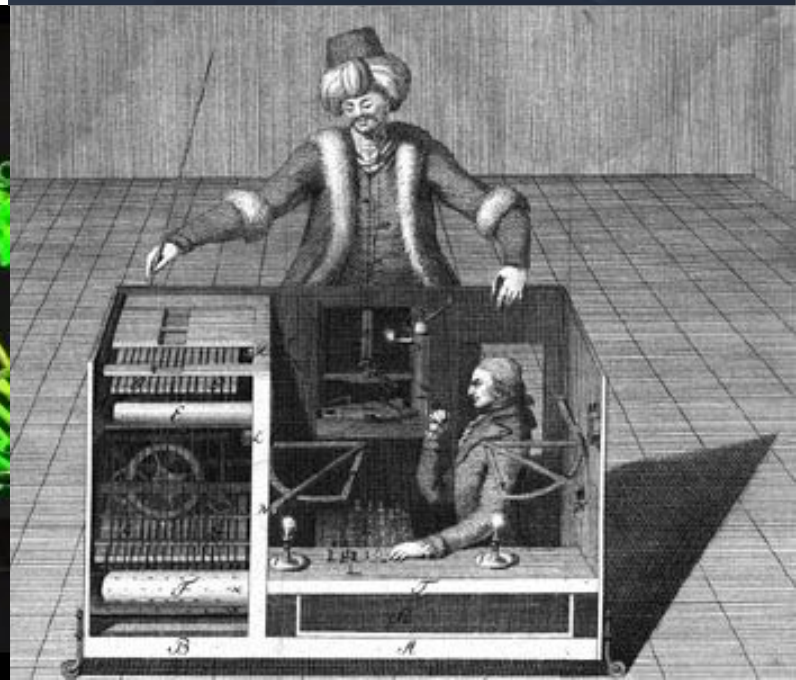
The metaverse: utopia or dystopia?

Crowdsourcing: Human-machine collaboration

Harness the power of the crowd

Combine human intelligence
with machine computation





Challenges for designers

Grudin (1994)

Jonathan Grudin

- Who does the work vs. who gets the benefit
- Critical mass and Prisoner's dilemma problems
- Disruption of social processes
- Exception handling
- Unobtrusive accessibility
- Difficulty of evaluation
- Failure of intuition
- Careful adoption process

Privacy, and other social behaviors

"On the Internet, nobody knows you're a dog."

Plausible deniability

Some references

C.A. Ellis, S.J. Gibbs, and G. Rein. "Groupware, some issues and experiences". *Communications of the ACM*, 34(1):39-58, January 1991.

J. Grudin. "Groupware and social dynamics: Eight challenges for developers". *Communications of the ACM*, 37(1):92-105, January 1994.

R. Baecker, editor. *Readings in Groupware and Computer-Supported Cooperative Work : Assisting Human-Human Collaboration*. Morgan-Kaufmann, December 1992. 882 pages.

M. Beaudouin-Lafon, editor. *Computer Supported Co-operative Work*. John Wiley & Sons Ltd, 1999. 258 pages.
http://www.lri.fr/~mbl/Trends-CSCW/